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970339 **27 January 1997 (27.01.97)** **FI**(71) Applicant (for all designated States except US): **TELECOM FINLAND OY [FI/FI]; Sturenkatu 16, FIN-00510 Helsinki (FI).**

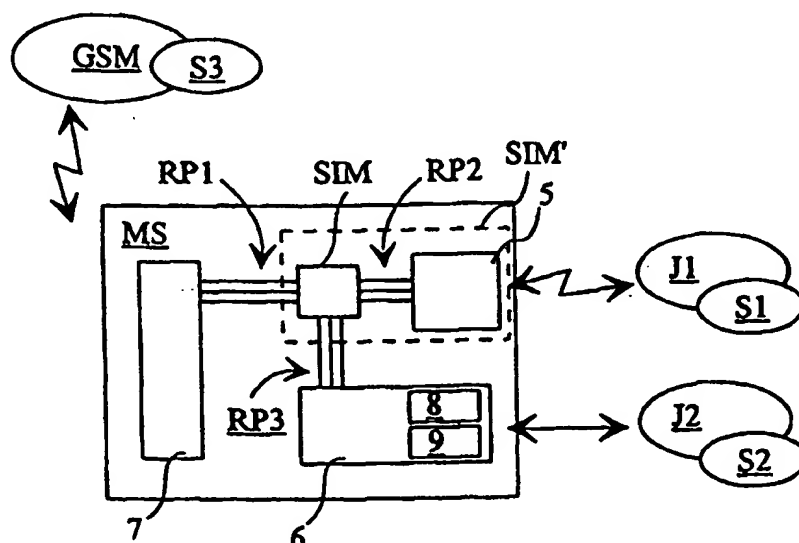
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(54) Title: **SUBSCRIBER IDENTITY MODULE MOBILE STATION AND METHOD FOR PERFORMING A SMART CARD FUNCTION**

(57) Abstract

The invention relates to a subscriber identity module that makes it possible to integrate different smart card functions with the SIM card used in a mobile station. The object of the invention is to enable new diversified service combinations to be implemented so as to allow them to be utilised via a data communication device, such as a mobile station. A feature characteristic of these service combinations is that a part of the series of actions is carried out in a system and/or application external to the data communication system and the data communication system/application in addition to or instead of wireless communication between the mobile station and the data communication system/application.

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SUBSCRIBER IDENTITY MODULE MOBILE STATION AND METHOD FOR PERFORMING A SMART CARD FUNCTION

The present invention relates to a subscriber identity module as defined in the preamble of claim 1.

5 Moreover, the invention relates to a mobile station as defined in the preamble of claim 5. The invention also relates to a procedure for applying a subscriber identity module and a mobile station as defined in the preamble of claim 10.

10 In prior art, a subscriber identity module is known that comprises a memory device, a data processing device connected to it and an interface for connection to a mobile station. Further, in a known method of communication between a subscriber identity module and a mobile station, the mobile station initiates the connection. The subscriber identity module as known at present cannot initiate communication with the mobile station. An example of such a system is the GSM system (*GSM, Global System for Mobile Communications*).
15 Moreover, a subscriber identity module card is known in which a single physical card may contain several independent subscriber identity modules. An example of such a system is a SIM card (*SIM, subscriber identification module*) used in the GSM system that
20 has two processors on opposite sides of the card. In the GSM mobile telephone network, the SIM card is a component which, in addition to the subscriber's international telephone number, also contains other stored user-specific and network-specific data, such as
25 the user's coded speed dialling numbers, a password to prevent misuse, and international codes of interconnected systems. A priority level for congestion situations can also be defined for the card. With the double SIM card described above, the user gets two separate subscriber connections, i.e. the user may make
30 private calls at his/her own cost and on-duty calls at

the cost of his/her employer. A circumstance characteristic of such a solution is that the two processors on the card are unable to communicate between themselves. In other words, the solution described above basically corresponds to a situation where two SIM cards
5 are disposed on the same carrier.

On the other hand, a smart card is known whose structure mainly corresponds to the above-described subscriber identity module. A smart card is generally
10 used e.g. as an access card, a key or as a bank card. In prior art, many different types of physical interface between the smart card and the external world are known. The card may be e.g. in galvanic contact with the external world. There may also be a wireless con-
15 nection between the card and the external world. In this case, both the card and the card reader are provided with coils, between which both information and power needed for the functions of the card are transferred. Therefore, the card can communicate with the ex-
20 ternal world at radio frequencies without a physical contact with a reader device. Examples of this type of cards are the remote-read cards used e.g. in buses.

It is also known in prior art that the subscriber identity module, or SIM, may communicate
25 with a mobile station and a physical transmission network over a standardised interface. The data on the SIM card can be changed via the air interface by transferring information to the card using short messages, e.g. SMS and USSD messages (*SMS, Short*
30 *Message Service; USSD, Unstructured Supplementary Ser-*vice Data). It is also possible to use a telecommunication terminal to change the data on the SIM card.

Further, many prior-art systems requiring user identification are based on a card identifying
35 the user. Such systems include e.g. access control systems. Cards identifying the user are also used in various transactions in which the card indicates that

a payment has been remitted beforehand or registers the transaction as a credit transaction. Examples of such systems are remote-read bus tickets and credit cards issued by banks. In such systems, the updating
5 of the cards is always done either by physically recharging the card with additional rights using a charger or by replacing an outdated disposable card with a new one. Another alternative is to update the reader, but this is only possible in the case of a li-
10 mited number of users.

A problem with these systems is that the user must carry several different cards used in different systems. When using different systems, the user always needs a certain card designed for the particular sys-
15 tem.

A further problem ~~is that~~ the various actions for updating of the cards, such as recharging the cards with money, changing the validity time, checking credit information and similar actions must always be
20 carried out separately for each card at different points. For example, a money card is recharged at a bank, a credit card is updated on the premises of the commercial enterprise giving the credit, a bus ticket is updated at a kiosk, and so on.

25 The object of the present invention is to produce a new type of subscriber identity module that makes it possible to combine several cards used in different systems.

Another object of the invention is to produce
30 a subscriber identity module that makes it possible to unify the use of different cards, in other words, a subscriber identity module that allows the information on cards of different systems to be updated in a centralised manner and almost independently of location by
35 using a mobile station.

A further object of the invention is to produce a mobile station that makes it possible to combi-

ne the functions of different smart cards and that can be used in more versatile ways and also for purposes other than its conventional function.

A further object of the invention is produce
5 a procedure that allows more diversified functions to be performed using a mobile station.

In short, the object of the invention is to enable new diversified service combinations to be so implemented that they can be utilised via a data communication device, such as a mobile station. A feature
10 characteristic of these service combinations is that a part of the series of actions is carried out in a system and/or application external to the data communication system and the data communication device.

15 As for the features characteristic of the invention, reference is made to the claims.

The subscriber identity module of the invention comprises a data processing device, which may be a very simple logic circuit or a more complex micro-processor. In addition, the module comprises a memory
20 device connected to the data processing device. The memory device may be any known type of memory, such as ROM, RAM, EPROM or EEPROM. Furthermore, the subscriber identity module of the invention comprises a first data transfer device, which is connected to the data
25 processing device and provided with a first interface for data transfer between a mobile station (MS) and the subscriber identity module. The data transfer device may be e.g. in galvanic contact with the mobile
30 station.

According to the invention, the subscriber identity module comprises a second data transfer device, which is connected to the data processing device and provided with a second interface, over which a
35 connection for data transmission to a device and/or application other than a mobile station is set up. This other device and/or application may be any exter-

nal system provided with means for reading and/or writing data over the second interface. The subscriber identity module may also comprise more than two data transfer devices and/or interfaces.

5 In an embodiment of the present invention, the subscriber identity module comprises a reading and writing device connected to the data processing device via the second data transfer device. This reading and writing device may be a remote device as generally used
10 ed e.g. in smart cards, in which information and the power needed by the module is transferred via windings or an equivalent medium. On the other hand, the reading and writing device may be an infrared operated device, in which the signalling takes place in the
15 infrared wavelength range.

The invention further relates to a mobile station comprising a subscriber identity module as described above. The mobile station may preferably comprise a remote device as described above, connected
20 over an interface to the subscriber identity module. In this case, the subscriber identity module itself may only contain a second data transfer device with a second interface, over which the desired connection to the remote device in the mobile station is set up.

25 In the procedure of the invention for performing a smart card function using a mobile station as described above, a connection between the subscriber identity module and a first external system is first established. This connection setup initialises the
30 smart card transaction and it comprises exchange of information relating to the subscriber identity module and the external system. After this, the user is requested to give his/her approval for the execution of the smart card transaction. The request can be presented
35 ed e.g. via the display of the mobile station or via a sound signal or a corresponding action. Finally, the first external system is informed of the user's appro-

val. On the other hand, in an embodiment of the invention, in addition to or instead of the user's approval, it is possible to request the approval of a second external system for the execution of the smart card transaction.

In a preferred embodiment of the procedure, predetermined information for the smart card transaction is stored in the subscriber identity module and the information is updated based on the smart card transaction under control of the first system. Such information may relate e.g. to the recharging of a rechargeable money card, in which the amount of money stored on the card is reduced on the basis of transactions.

The connection to the second external system is preferably established via a mobile communication network. The connection can be set up using short messages, such as SMS and/or USSD messages.

As compared with prior art, the present invention affords the advantage that the subscriber identity module of the invention makes it possible to combine several cards used in different systems. Further, the invention makes it possible to unify the use of different cards included in the subscriber identity module, in other words, it makes it possible to update the information on cards of different systems in a centralised manner and almost independently of location by using a mobile station. In addition, the invention allows various smart card services to be used with a single card.

In addition, the invention makes it possible to produce a mobile station by means of which the functions of different smart cards can be used and which can be used in more versatile ways and also for other purposes besides its conventional function. As a further advantage, the procedure of the invention pro-

vides a handy way to implement the previously slow and difficult smart card functions.

In the following, the invention will be described by the aid of some examples of its embodiments by referring to the attached drawing, in which

Fig. 1 presents a subscriber identity module according to the invention;

Fig. 2 presents a diagram representing a mobile station according to the invention;

Fig. 3 represents the signalling in a preferred embodiment of the present invention; and

Fig. 4a - 4c are flow diagrams representing certain preferred embodiments of the procedure of the invention.

The subscriber identity module SIM presented in Fig. 1 comprises a processor circuit 1 which controls all functions of the module. Moreover, the module comprises a memory circuit 2, which is connected to the processor circuit and contains all the software needed in the module, such as the operating system, data transfer protocols for different interfaces, and other programmes required. In addition, the module comprises a first data transfer device 3, which includes the functions for the establishment of a first interface RP1 and is used to set up a connection to a mobile station MS. Furthermore, the module comprises a second data transfer device 4, which comprises the functions for the establishment of a second interface RP2 and is used to set up a connection to a second system, e.g. to a remote-read card connected to the subscriber identity module.

The subscriber identity module presented in Fig. 1 also has other preferred embodiments, which are not actually shown in the figure but which are obvious to the skilled person from Fig. 1. One embodiment is a module that contains several processor circuits accessing a common memory area. In this case, one processor

takes care of one interface to the external world. In such an arrangement, it is necessary to ensure that when one processor is writing information to the common memory area, the others cannot read it simultaneously from the same memory area. A mechanism of this type is known e.g. from database solutions.

Another embodiment is a card with a single processor whose capacity is shared between several processes. In this case, one process takes care of data communication over one interface. Such a solution is known e.g. from the computer world. For example, the UNIX operating system can work with a single processor by utilising the processor's multitasking capability. This is the way the card would function in this embodiment. A further possibility is to use a hybrid solution comprising more than one processor but having a number of interfaces that is not the same as the number of processors.

The GSM mobile station MS represented by the diagram in Fig. 2 comprises a SIM' that has been slightly modified from the subscriber identity module SIM in Fig. 1. In addition to a module according to Fig. 1, SIM' comprises a remote-read card 5. The remote-read card 5 is connected via a wireless link to a first system J1, in which a first application S1 is operated. The subscriber identity module SIM is connected to the remote-read card via a second interface RP2. The mobile station MS further comprises an infrared device 6 comprising both an infrared transmitter 8 and an infrared receiver 9. The infrared device can also be used as a bar code reader, and the information read from an application S2 operated in a second system J2 can be transferred over a third interface RP3 into the subscriber identity module for further processing. The mobile station MS further comprises a matching module 7, which is used to establish a connection to the subscriber identity module SIM over the

first interface. In addition, as shown in Fig. 2, the mobile station communicates over a wireless connection with a GSM system and an application/applications S3 operated in it.

5 Fig. 3 represents the signalling between different parts of the assembly in a preferred embodiment of the present invention. This series of actions is also represented by the flow chart in Fig. 4a.

10 In Fig. 3, the server 10 is a computer comprised in a physical transmission medium, such as a GSM network, and it is capable of communicating in the manner required by the application in the subscriber identity module card. An external system J1, e.g. a remote reader, sends a debiting message, containing
15 information about a sum to be debited, to an application in the subscriber identity module SIM, block 21. The application in the subscriber identity module device SIM recognises the message as one sent by an external device and forwards it via a physical interface,
20 e.g. a GSM network, as a short message, such as an SMS or USSD message, to a suitable server 10 in the GSM network. Before forwarding the message, block 22, the application in the subscriber identity module SIM may require an approval of the function from the user.
25 If no approval is obtained, the transaction is terminated, block 23. The message received from the reader J1 must contain an identifier informing the application in the subscriber identity module SIM that a response to the message is expected. The server 10 in
30 turn must contain a programme that is able to interpret the messages arriving from the subscriber identity module SIM and respond to them appropriately. An appropriate response may involve e.g. verification of the creditworthiness of the subscriber identity module
35 that sent the SMS or USSD message, and the granting or turning down of credit. A response indicating granting or rejection of credit is sent to the subscriber iden-

tity module in the form of an SMS or USSD or other short message, which is identified by the module application as a response to a message sent out shortly before, and forwarded to an external reader J1, block 24. The arrival of a response in the reader J1 must be indicated e.g. by a sound signal. If an affirmative answer is received, the reader J1 responds by printing a receipt for the payment. If the answer is negative, the reader J1 responds by announcing that the payment could not be made, block 25.

An SMS sent by the subscriber identity module SIM must contain a code (e.g. IMSI in the GSM system) identifying the subscriber identity module, the amount debited as well as other information relating to the debiting, such as the date and the place and time of purchase. Moreover, the system must contain encryption and authentication mechanisms.

Referring to Fig. 4b, if the subscriber identity module card in the transaction illustrated by the figure is a so-called prepaid card, no debiting will have to be done from the server 10. Instead, money is first loaded into the module SIM e.g. using a SMS message, block 31. The procedure continues by first reading into the subscriber identity module SIM the sum to be debited, block 32, and then debiting the customer by decreasing (block 33) his/her payment tickets created beforehand on the card SIM. Finally, the seller's system J1 is informed of the remittance.

Correspondingly, in a third example, represented by the flow diagram in Fig. 4c and relating to access control, the signalling is based on the use of a GSM network as a physical transmission link by making use of short messages, such as SMS or USSD messages to transmit information. The user requests access by sending either an SMS, USSD or other short message, block 41. To be able to make the request, the subscriber identity module card SIM must contain an

application that knows how to ask both the user and the server for the right things. In GSM cards, this could be implemented using an Application Toolkit consistent with the GSM standards. The server must perform the required actions to allow or deny access and, if necessary, to debit the user for the permission, in which case the user's creditworthiness must be verified or tickets decreased on a prepaid card. As in the previous example, in this case, too, the server receives information indicating that a response to the message is expected. An external reader verifies the user's right of access by asking the subscriber identity card about the right of access. If the card has the right of access, the reader will indicate this by giving a sound signal or by opening the door. In the case of a card with a right of access granted for a certain period, the right can be removed from the card by sending a new SMS, USSD or other short message and deleting the field indicating right of access.

Another arrangement for verifying the right of access of the card is that the information regarding right of access is located in the reader instead of on the card, and a server in the transmission network sends the reader J1 information regarding the right of access of each card at certain intervals. In this case, the reader J1 only asks the card SIM for an identification number, block 42, and compares it with its own data to decide about the user's right of access, block 43. In the case of rights granted for a certain period, the right of access expires when the card number is no longer updated in the reader as an allowed number entitled to access. In the case of the solution described, the server could be provided with a timer whose triggering would result in removing outdated card numbers indicating right of access.

To sum up, let it be stated that in practice the actions described above are realised by briefly

exposing a telephone to a remote reader and verifying the transaction via the user interface of the telephone, whereupon the transaction is recorded in the remote reader. Depending on the nature of the transaction, either a data link is needed between the remote reader and the data system or the files in the remote reader are transferred into the data system e.g. at the end of each day. Thus, a user having a mobile station with a suitable card in it will be able to carry out various smart card functions using only his/her telephone.

The invention is not restricted to the examples of its embodiments described above, but many variations are possible within the scope of the inventive idea defined by the claims.

CLAIMS

1. Subscriber identity module (SIM), comprising a data processing device (1), a memory device (2) connected to the data processing device, and a first data transfer device (3), which is connected to the data processing device and provided with a first interface (RP1) for data transfer between a mobile station (MS) and the subscriber identity module, characterised in that the subscriber identity module (SIM) comprises a second data transfer device (4), which is connected to the data processing device (1) and provided with a second interface (RP2), over which a data transfer connection to a device and/or application other than a mobile station is set up.

2. Subscriber identity module as defined in claim 1, characterised in that the subscriber identity module (SIM) comprises a reading and writing device (5) connected to the data processing device (1) via the second data transfer device (4).

3. Subscriber identity module as defined in claim 1 or 2, characterised in that the reading and writing device (5) is a remote device.

4. Subscriber identity module as defined in any one of claims 1 - 3, characterised in that the reading and writing device (5) is an infrared device.

5. Mobile station comprising a subscriber identity module that comprises a data processing device (1), a memory device (2) connected to the data processing device, and a first data transfer device (3), which is connected to the data processing device and provided with a first interface for data transfer between the mobile station (MS) and the subscriber identity module, characterised in that the subscriber identity module (SIM) comprises a second data transfer device (4), which is connected to the

data processing device (1) and provided with a second interface, a data transfer connection being set up over the second interface to a device and/or application other than a mobile station.

5 6. Mobile station as defined in claim 5, characterised in that the subscriber identity module (SIM) comprises a reading and writing device (5) connected to the data processing device (1) via the second data transfer device (4).

10 7. Mobile station as defined in claim 5 or 6, characterised in that the reading and writing device (5) is a remote device.

 8. Subscriber identity module as defined in any one of claims 5 - 7, characterised in
15 that the reading device (5) is an infrared device.

 9. Mobile station as defined in any one of claims 5 - 7, characterised in that the mobile station comprises a remote device (6) connected over a third interface (RP3) to the subscriber identity
20 module (SIM).

 10. Procedure for performing a smart card function using a mobile station as defined in claim 5, characterised in that

 a connection between the subscriber identity
25 module and a first external system is established;

 the user is requested to give his/her approval for the execution of the smart card function; and

 the first external system is informed of the user's approval.

30 11. Procedure as defined in claim 10, characterised in that a second external system is requested to give its approval for the execution of the smart card function.

 12. Procedure as defined in claim 10 or 11,
35 characterised in that predetermined information for the smart card function is stored in the subscriber identity module and the information is up-

dated based on the smart card function under control of the first system.

13. Procedure as defined in any one of claims 10 - 12, characterised in that the connection
5 to the second external system is established via a mobile communication network.

14. Procedure as defined in claim 13, characterised in that short messages, preferably SMS and/or USSD messages, and/or other message
10 transmission methods defined in the GSM standard are used for the transmission of information in the mobile communication network.

1/2

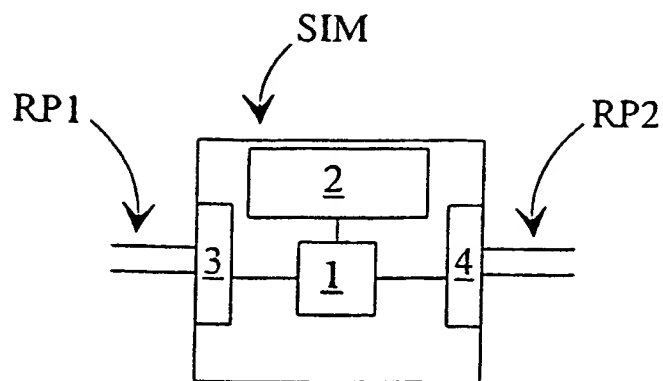


Fig 1

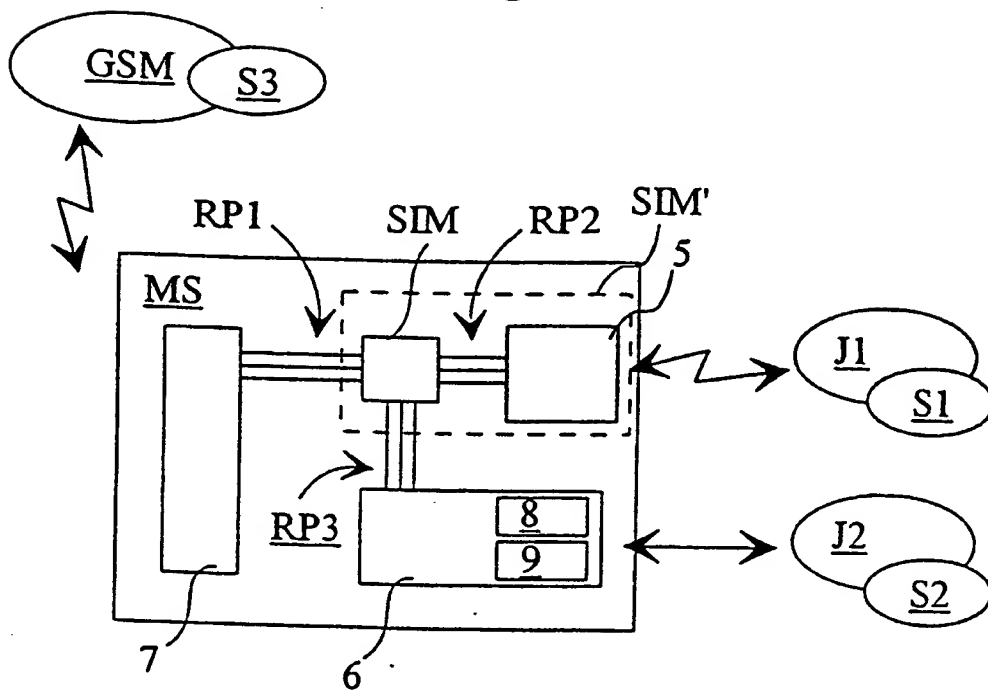


Fig 2

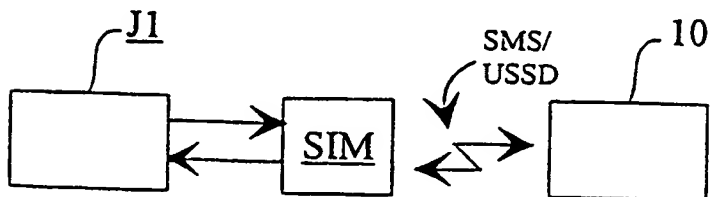


Fig 3

2/2

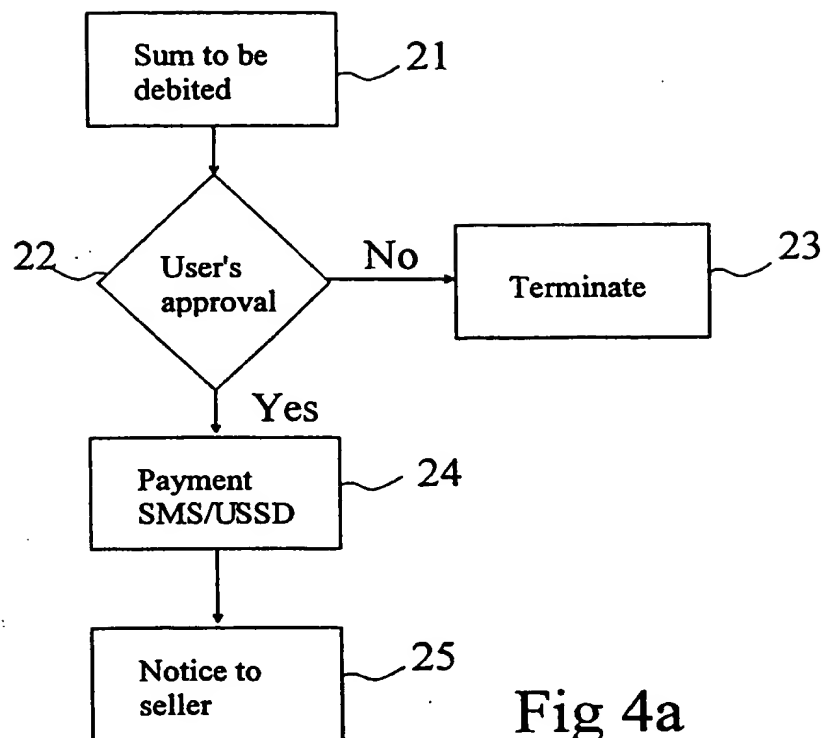


Fig 4a

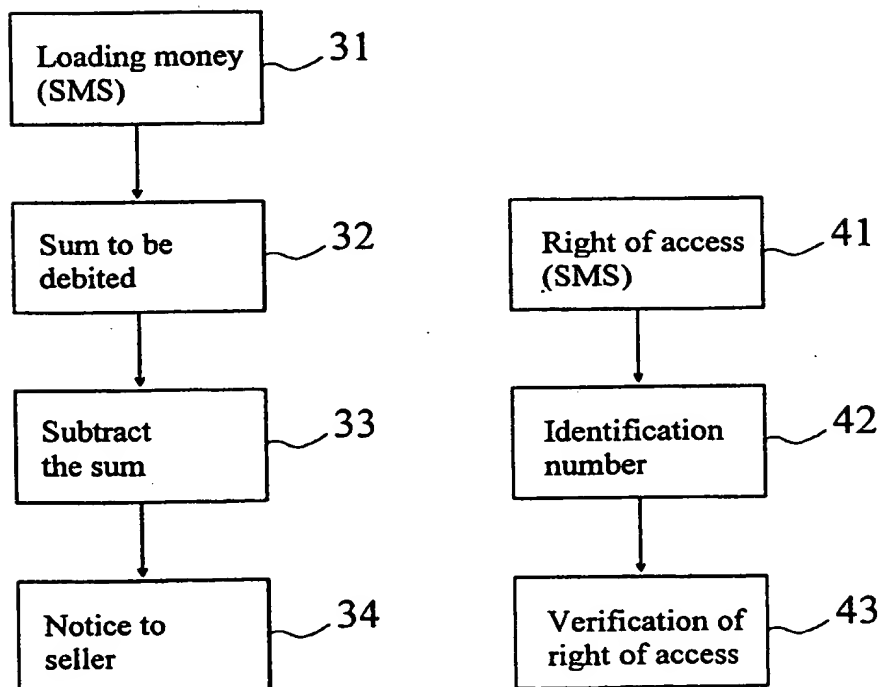


Fig 4b

Fig 4c

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 98/00080

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04Q 7/32, G07F 7/08, G06K 19/073

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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EPODOC, WPI, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9411849 A1 (VATANEN, H.T.), 26 May 1994 (26.05.94), page 6, line 20 - line 26 --	1,5,10
A	US 5353328 A (M. JOKIMIES), 4 October 1994 (04.10.94), abstract --	1,5
P,A	WO 9744762 A1 (GEMPLUS, S.C.A.), 27 November 1997 (27.11.97), abstract --	1-14
P,A	WO 9741499 A2 (MARTINEZ, J.R.), 6 November 1997 (06.11.97), claim 1 --	1-14

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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P,A	FR 2740291 A1 (SOCIETE D'APPLICATIONS GENERALES D'ELECTRICITE ET DE MECANIQUE SAGEM SOCIETE ANONYME), 25 April 1997 (25.04.97), abstract -- -----	1-14

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Information on patent family members

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International application No.

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